

(This equipment may be used with methanol-fueled Otto-cycle vehicles; however, particulates need not be measured for vehicles that are waived from the requirement). All vehicles equipped with evaporative canisters are preconditioned by loading the canisters with hydrocarbon vapors. Petroleum-fueled diesel vehicles are excluded from this requirement.

(3) *Fuel, analytical gas, and driving schedule specifications.* Fuel specifications for exhaust and evaporative emissions testing and for mileage accumulation are specified in § 86.113. Analytical gases are specified in § 86.114. The EPA Urban Dynamometer Driving Schedule (UDDS) for use in exhaust emissions tests is specified in § 86.115 and appendix I of this part.

(b) [Reserved]

[58 FR 16026, Mar. 24, 1993, as amended at 59 FR 48504, Sept. 21, 1994; 60 FR 43888, Aug. 23, 1995; 64 FR 23921, May 4, 1999]

§ 86.107-90 Sampling and analytical system; evaporative emissions.

(a) Component description (evaporative emissions sampling system). The following components will be used in evaporative emissions sampling systems for testing under this subpart.

(1) *Evaporative emission measurement enclosure.* The enclosure shall be readily sealable, rectangular in shape, with space for personnel access to all sides of the vehicle. When sealed, the enclosure shall be gas tight in accordance with § 86.117. Interior surfaces must be impermeable and non-reactive to hydrocarbons and to methanol (if the enclosure is used for methanol-fueled vehicles). One surface should be of flexible, impermeable and non-reactive material to allow for minor volume changes, resulting from temperature changes. Wall design should promote maximum dissipation of heat, and if artificial cooling is used, interior surface temperatures shall not be less than 68 °F (20 °C).

(2) *Evaporative emission hydrocarbon and methanol analyzers.* (i) For gasoline- and methanol-fueled vehicles a hydrocarbon analyzer utilizing the hydrogen flame ionization principle (FID) shall be used to monitor the atmosphere within the enclosure (a heated FID (HFID)(235±15 °F (113±8 °C)) is

recommended for methanol-fueled vehicles). Instrument bypass flow may be returned to the enclosure. The FID shall have a response time to 90 percent of final reading of less than 1.5 seconds, and be capable of meeting performance requirements expressed as a function of Cstd: where Cstd is the specific enclosure hydrocarbon level, in ppm, corresponding to the evaporative emission standard:

(A) Stability of the analyzer shall be better than 0.01 Cstd ppm at zero and span over a 15-minute period on all ranges used.

(B) Repeatability of the analyzer, expressed as one standard deviation, shall be better than 0.005 Cstd ppm on all ranges used.

(ii) For methanol-fueled vehicles, a methanol sampling and analyzing system is required in addition to the FID analyzer. The methanol sampling equipment shall consist of impingers for collecting the methanol sample and appropriate equipment for drawing the sample through the impingers. The analytical equipment shall consist of a gas chromatograph equipped with a flame ionization detector. (NOTE: For 1990 through 1994 model year methanol-fueled vehicles, a HFID calibrated on methanol may be used in place of the HFID, calibrated on propane plus the methanol impingers and associated analytical equipment).

(iii) The methanol sampling system shall be designed such that, if a test vehicle emitted the maximum allowable level of methanol (based on all applicable standards) during any phase of the test, the measured concentration in the primary impinger would exceed either 25 mg/l or a concentration equal to 25 times the limit of detection for the GC analyzer, and such that the primary impinger collects at least 90 percent of the analyte in the samples. The remaining analyte shall be collected by the secondary impinger. This requirement does not apply to dilution air samples, since they do not require secondary impingers, or to samples in which the concentrations approach the limit of detection. The provisions of this paragraph apply to the design of sampling systems, not to individual tests.

(3) *Evaporative emission hydrocarbon and methanol data recording system.* (i) The electrical output of the FID used for measuring hydrocarbons (or hydrocarbons plus methanol as appropriate) shall be recorded at least at the initiation and termination of each diurnal or hot soak. The recording may be by means of a strip chart potentiometric recorder, by use of an on-line computer system or other suitable means. In any case, the recording system must have operational characteristics (signal to noise ratio, speed of response, etc.) equivalent to or better than those of the signal source being recorded, and must provide a permanent record of results. The record shall show a positive indication of the initiation and completion of each diurnal or hot soak along with the time elapsed between initiation and completion of each soak.

(ii) For the methanol sample, permanent records shall be made of the following: the volumes of deionized water introduced into each impinger, the rate and time of sample collection, the volumes of each sample introduced into the gas chromatograph, the flow rate of carrier gas through the column, the column temperature, and the chromatogram of the analyzed sample.

(4) *Tank fuel heating system.* The tank fuel heating system shall consist of a heat source and a temperature controller. A typical heat source is a 2000 W heating pad. Other sources may be used as required by circumstances. The temperature controller may be manual, such as a variable voltage transformer, or may be automated. The heating system must not cause hot spots on the tank wetted surface which could cause local overheating of the fuel. Heat must not be applied to the vapor in the tank above the liquid fuel. The temperature controller must be capable of controlling the fuel tank temperature during the diurnal soak to within $\pm 3^\circ\text{F}$ ($\pm 1.7^\circ\text{C}$) of the following equation:

$$F = T_o + (0.4)t.$$

or *For SI units:*

$$C = T_o + (2/9)t.$$

Where:

F = Temperature in $^\circ\text{F}$.

C = Temperature in $^\circ\text{C}$.

t = Time since start of test in minutes.

T_o = initial temperature in $^\circ\text{F}$ (or in $^\circ\text{C}$ for SI units).

(5) *Temperature recording system.* Strip chart recorder(s) or automatic data processor shall be used to record enclosure ambient and vehicle fuel tank temperature during the evaporative emissions test. The temperature recorder or data processor shall record each temperature at least once every minute. The recording system shall be capable of resolving time to $\pm 15\text{s}$ and capable of resolving temperature to $\pm 0.75^\circ\text{F}$ ($\pm 0.42^\circ\text{C}$). The temperature recording system (recorder and sensor) shall have an accuracy of $\pm 3^\circ\text{F}$ ($\pm 1.7^\circ\text{C}$). The recorder (data processor) shall have a time accuracy of $\pm 15\text{s}$ and a precision of $\pm 15\text{s}$. Two ambient temperature sensors, connected to provide one average output, shall be located in the enclosure. These sensors shall be located at the approximate vertical centerline of each side wall extending 4 inches (nominally) into the enclosure at a height of $3\pm 0.5\text{ ft}$ ($0.9\pm 0.2\text{ m}$). The vehicle fuel tank temperature sensor shall be located in the fuel tank so as to measure the temperature of the prescribed test fuel at the approximate mid-volume of the fuel. Manufacturers shall arrange that vehicles furnished for testing at Federal certification facilities be equipped with iron-constantan Type J thermocouples for measurement of fuel tank temperature.

(6) *Purge blower.* One or more portable or fixed blowers shall be used to purge the enclosure. The blowers shall have sufficient flow capacity to reduce the enclosure hydrocarbon and/or methanol concentration from the test level to the ambient level between tests. Actual flow capacity will depend upon the time available between tests.

(7) *Mixing blower.* One or more small blowers or fans with a total capacity of 200 to 1000 cfm shall be used to mix the contents of the enclosure during evaporative emission testing. No portion of the air stream shall be directed toward the vehicle. Maintenance of uniform concentrations throughout the enclosure is important to the accuracy of the test.

(b) [Reserved]

[54 FR 14499, Apr. 11, 1989, as amended at 60 FR 34335, June 30, 1995]